Systems of Measurements

English (Imperial) System

12 inches = 1 foot = .33 yards = 0.000189 miles

16 tablespoons = 8 oz = 1 cup = 0.5 pints = 0.25 quarts = 0.625 gallons

16 oz = 1 lb = 0.0005 tons

What do you notice about this system of measurement?

Systems of Measurements

Metric System

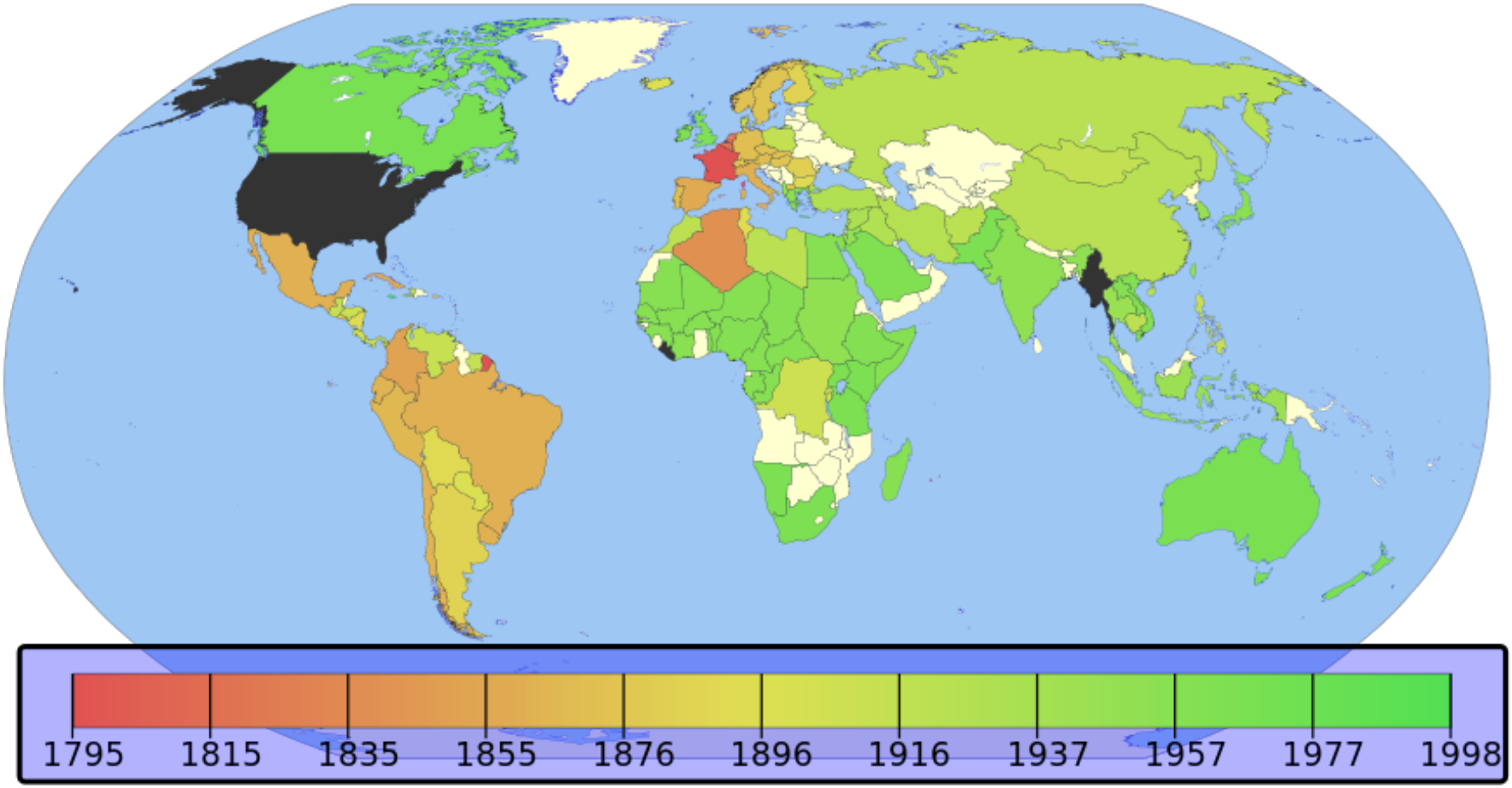
1,000 mm = 100 cm = 1 m = 0.001 km

20,000 mL = 2,000 cL = 20 L = 0.020 kL

5,000 g = 5 kg

1 TB = 1,000 GB = 1,000,000 MB = 1,000,000,000 kB = 1,000,000,000,000 B

What do you notice about this system of measurement?



Countries by date of metrication. Colours red to green show the pattern of metrication from 1795 to 1998. Black identifies countries that have not adopted the metric system as the primary measurement system. White identifies countries that already used the metric system at the time they gained their independence.

The Metric System

1. Base measurements
   a. Length - meter
   b. Mass - gram
   c. Volume - liter

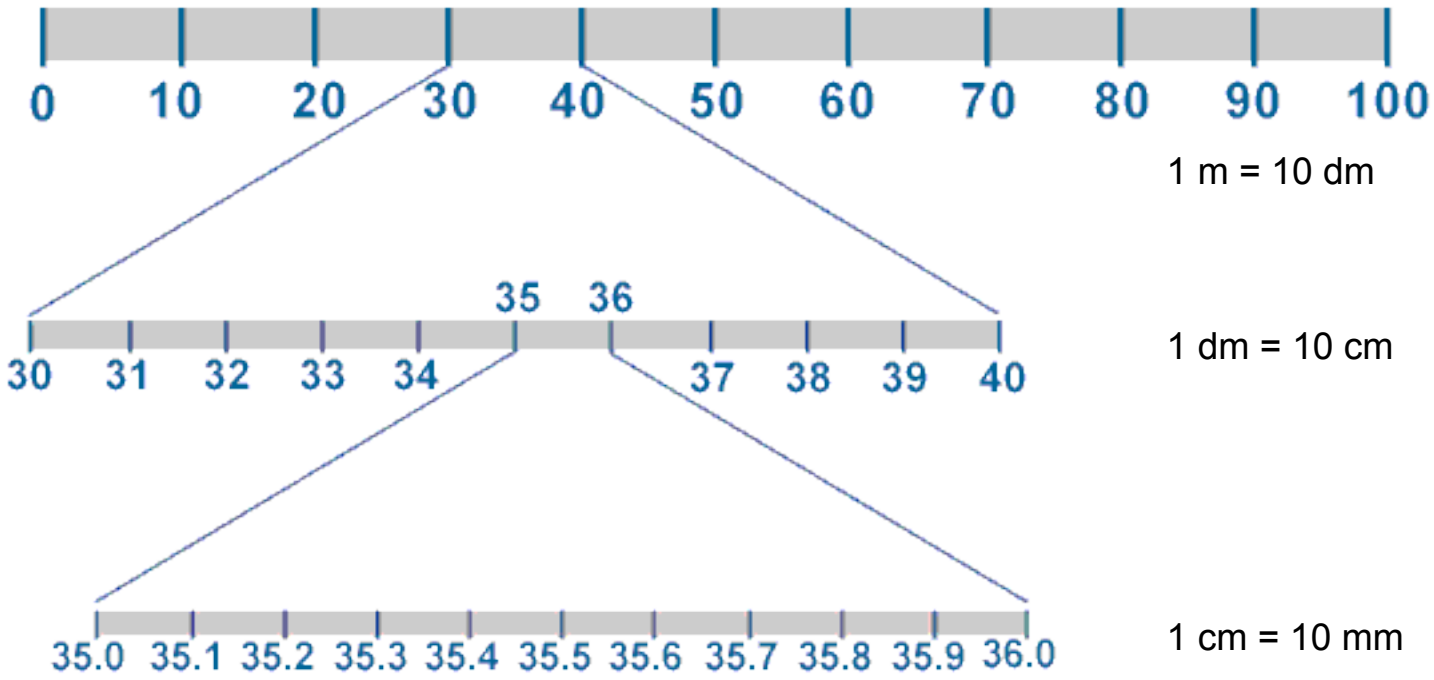
2. Uses Metric Prefixes to indicate measurements other than the base measurements. These would be used for situations where measuring with the base would not make sense
   a. measuring the distance between your home and the school you would use kilometers rather than meters just as you would use miles rather than feet.

SI Prefixes

Prefix	Symbol	Meaning	Multiply Unit by
giga-	G	billion (10^9)	1,000,000,000
mega-	M	million (10^6)	1,000,000
kilo-	k	thousand (10^3)	1000
deci-	d	tenth (10^{-1})	0.1
centi-	c	hundredth (10^{-2})	0.01
milli-	m	thousandth (10^{-3})	0.001
micro-	μ	millionth (10^{-6})	0.000001
nano-	n	billionth (10^{-9})	0.000000001

The Metric System

3. Metric Prefixes are based on powers of ten - this means multiplying or dividing a number by ten a certain number of times

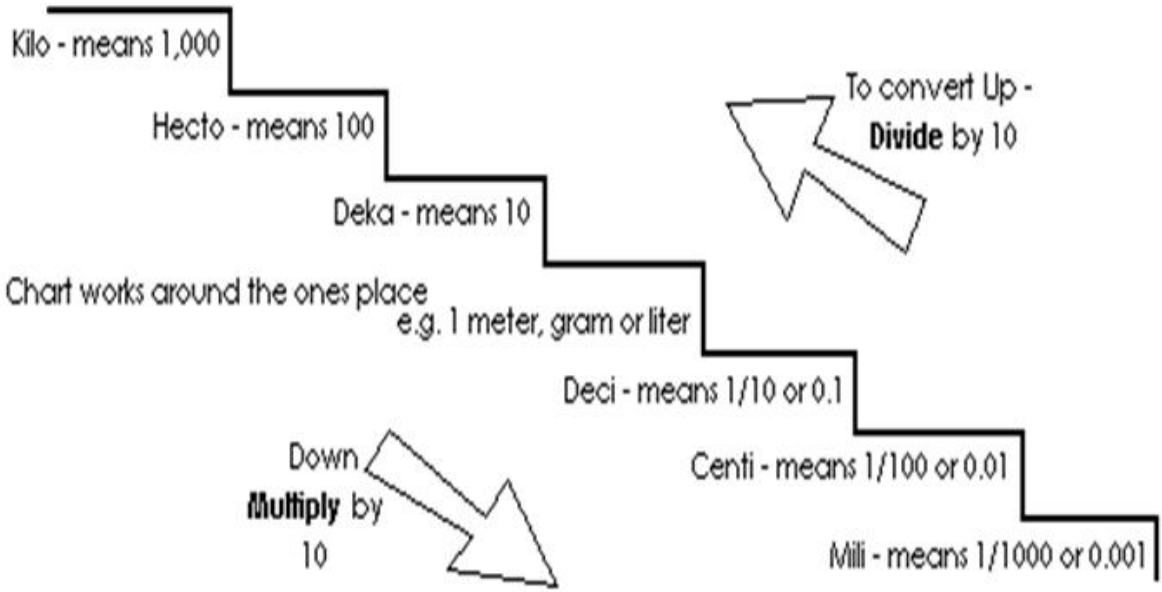


U = BASE (METERS, LITERS, GRAMS)

kilo	hecto	deca	U	deci	centi	milli…	micro
k	h	da		d	c	m	μ
0.001	0.01	0.1	1	10	100	1000	1000000
OR							
$x10^{-3}$	$x10^{-2}$	$x10^{-1}$	1	$x10^{1}$	$x10^{2}$	$x10^{3}$	$x10^{6}$

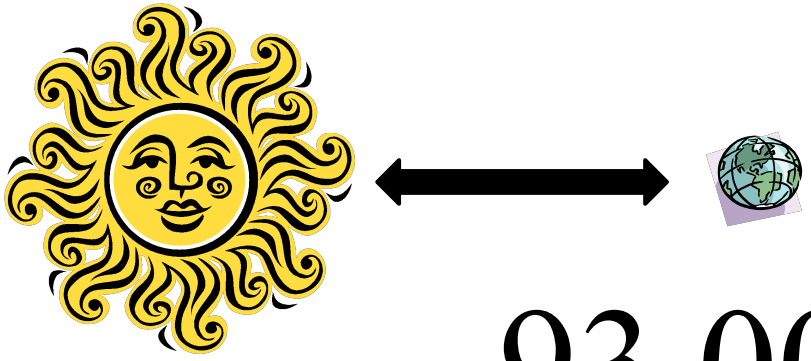
METRIC SYSTEM

(K)ING	**Kilometer**	**1000m**	**10^3**
(H)enry	**Hectometer**	**100m**	**10^2**
(D)ied	**Decameter**	**10m**	**10^1**
(W)hile	**Standard**	**1m**	**10^0**
(D)rinking	**Decimeter**	**.1m**	**10^{-1}**
(C)hocolate	**Centimeter**	**.01m**	**10^{-2}**
(M)ilk	**Millimeter**	**.001m**	**10^{-3}**



Scientific Notation

1. A short-hand way of writing **LARGE** / **SMALL** numbers without writing all of the zeros.



93,000,000 miles

0.0000930 m

Scientific Notation

Step 1

- Move decimal to leave only one digit in front of decimal

$93{,}000{,}000 = 9.3000000$

$0.00000930 = 9.30$

Scientific Notation

Step 2

- Write number without zeros

93,000,000 = 9.3

0.0000930 = 9.3

Scientific Notation

Step 3

- Count how many places you moved decimal
- The number of places you moved the decimal becomes your power of ten

$93{,}000{,}000 = 9.3 \times 10^{7}$

$0.0000930 = 9.3 \times 10^{-5}$

The powers of ten are 7 and -5 respectively because the decimal moved 7 & 5 places. Positive indicates large numbers (to write the number in scientific notation the decimal had to be moved to the left) while negative indicates small number (to write the number in scientific notation the decimal had to be moved to the right…. this is the case for numbers less than zero)

$$93{,}000{,}000 = 9.3 \times 10^{7}$$

$$0.000093 = 9.3 \times 10^{-5}$$

Scientific Notation

The distance between the sun and the earth is 93,000,000 miles

The distance between the sun and the earth is 9.3×10^{7} miles.

A piece of paper is roughly 9.0×10^{-5} m thick.

A piece of paper is roughly 0.000093 m thick.

Scientific Notation Practice

Write in scientific notation.
Decide the power of ten.

1) $98{,}500{,}000 = 9.85 \times 10^{?}$ ⟶ 9.85×10^{7}
2) $64{,}100{,}000{,}000 = 6.41 \times 10^{?}$ ⟶ 6.41×10^{10}
3) $0.00000279 = 2.79 \times 10^{?}$ ⟶ 2.79×10^{-6}
4) $0.0042 = 4.2 \times 10^{?}$ ⟶ 4.2×10^{-3}

Scientific Notation Practice

For the following numbers, properly place the decimal to convert to scientific notation

1) 734,000,000 = _____ x 10^{8}
2) 870,000,000,000 = _____x 10^{11}
3) 0.0000000009 = _____ x 10^{-10}

Answers

1) 7.34×10^{8} 2) 8.7×10^{11} 3) 9×10^{-10}

Scientific Notation Practice

Write in scientific notation.

1) 0.0005

2) 7,200,000

3) 802,000,000,000

Answers

1) 5×10^{-4} 2) 7.2×10^{6} 3) 8.02×10^{11}

Scientific Notation

-To move from scientific notation to standard form move the decimal the number of times indicated by the exponent

-If the exponent is positive you will move the decimal to the left, if negative - you will move the decimal to the left

- 3.4×10^5 in scientific notation
- 3.40000 ---> move the decimal
- 340,000 in standard form

Scientific Notation Practice

Write in standard form.

- 6.27×10^{6}
- 9.01×10^{4}
- 2.73×10^{-2}
- 5.68×10^{-7}

- 6,270,000
- 90,100
- 0.0273
- 0.000000568

Dimensional Analysis

1. Every measurement must contain two things…
   a. A number - describes “how many”
      i. Example: 10

   b. A unit - describes “of what”
      i. apples

Dimensional Analysis

2. In order to add / subtract numbers they **MUST** have same unit.
    a. Ex: 5 apples + 5 pears can't be combined
    b. Ex: 1 bushell - 5 apples can't work
        i. need to convert "bushell to apples" or "apples to bushells"

3. Sometimes we need to change units to communicate with others

4. To convert the units we use dimensional analysis

Dimensional Analysis

- Steps when using dimensional analysis

Step 1	What quantity or rate are you asked for in the problem? Write it down.
Step 2	What do you know from reading the problem? List all known rates and quantities.
Step 3	Arrange the known quantities and rates to get an answer that has the right units. This arrangement might include a formula.
Step 4	Plug in the values you know.
Step 5	Solve the problem and write the answer with a number and a unit.

Dimensional Analysis

1. A grocery store just received a shipment of 200 cartons of eggs. Each carton holds one dozen eggs. If 12 eggs = 1 dozen, how many eggs did the store receive?

2. An aspirin tablet contains 325 mg of acetaminophen. How many grams is this equivalent to?

EXTRA PRACTICE:

1. 261 g -> kg

2. 3 days -> seconds

3. 9,474 mm -> cm

EXTRA PRACTICE:

4. You're throwing a pizza party for 15 people and figure that each person will eat 4 slices. You call up the pizza place and learn that each pizza will cost you $14.78 and it will be cut into 12 slices. How much is the pizza going to cost you? You only have $70. Will you have enough money?

5. Every three times I clean my bedroom, my mother makes me an apple pie. I cleaned my bedroom 9 times. How many apple pies does she owe me?

6. In my chemistry class, 28 students are each given 3 pens. If there are 8 pens in one package, priced at $1.88 per package, what is the total cost of giving away pens?